## REMARKS

Applicants wish to thank the Examiner for considering the present application. In the Final Office Action dated October 10, 2003, claims 1-5 and 7-37 are pending. Applicants request the Examiner for reconsideration of this application.

Claim 37 stands rejected under 37 CFR 112, second paragraph as being indefinite. Applicants have reworded this element to state that the waveguide corresponding to the strongest signal can be used for transmission. This is similar language to that of the other claims that the Examiner has found acceptable.

### I. Real Party in Interest

The real party in interest in this matter is Hughes Electronics Corporation of El Segundo, California, which is a wholly owned subsidiary of General Motors Corp.

### II. Status of the Claims

Claims 1-5 and 7-37 stand rejected in the Final Office Action. There have been no amendments filed subsequent to the final rejection.

### III. Summary of the Invention

The present invention relates generally to a low cost, low profile tracking phased array antenna for use on a commercial satellite terminal that is adapted for use with an equatorial satellite constellation system. Various tracking ground terminals exist, which are directed for use and sale in the consumer market. These antennas are typically configured as multi-beam tracking ground terminals, which include arrays with mechanisms for steering beams, such as phase shifters. These arrays further include integrated mechanisms for simultaneously tracking the pointing directions of

these multiple beams. With these systems, each beam has a separate set of electronics associated with each element to process the various signals, including multiple phase shifters and other associated processing circuitry. These systems, therefore, suffer from significant drawbacks. Specifically, these tracking antennas are relatively expensive because of the multiple sets of electronics and are bulky because of the size required to house the electronics.

The present invention has recognized these drawbacks and provides an antenna 10 having a rotating plate 16 for mechanically scanning for wave signals in azimuth. The rotating plate 16 includes a plurality of radiation elements 18 positioned thereon for electronically scanning for wave signals in elevation. Each of the radiation elements 18 is in communication with *coding circuitry coupling a respective code to the element signals* and apparatus, such as a multiplexer 44, which consolidates the wave signals received at each of the radiation elements to an analog bit stream. Thereafter, the analog bit stream is converted to a digital bit stream by an analog to digital converter 50. The digital bit stream is then transferred to a multiple beamforming device 54 which forms multiple digital beams. The digital beams are converted to information signals such that the antenna 10 can lock onto a second equatorial satellite in the constellation before locking off a first equatorial satellite. A digital receiver 64 is used to determine signal strengths for the coded element signals and to lock onto a strongest signal having a corresponding element, so that the corresponding element can be used for transmission.

**IV. Issues**

The following issues are presented in this response, each of which correspond directly to the Final Office Action, dated October 10, 2003:

Whether Claims 1, 4, 5, 7-9, 11, 13-18, 21-22, and 25-37 are patentable under 35 U.S.C. § 103(a) over *Karlsson et al.* in view of either one of *Chiba et al.*, *Chang* and *Aoki.*

Whether claims 2, 3, 10, 12, 19, 20, and 23-24 are patentable under 35 U.S.C. § 103(a) over the combined prior art above as applied to the claims set forth above and further in view of *Ajioka* and *Barrett et al.*

## V. Grouping of Claims

The rejected claims have been grouped together in each of their rejections. The Appellant states, however, that each of the rejected claims stands on its own recitation and is separately patentable for the reasons set forth in detail below.

Claims 1, 4, 5, 7-9, 11, 13-18, 21-22, and 25-37 stand rejected under 35 U.S.C. § 103(a) over *Karlsson et al.* in view of either one of *Chiba et al.*, *Chang* and *Aoki.*

Whether claims 2, 3, 10, 12, 19, 20, and 23-24 are patentable under 35 U.S.C. § 103(a) over the combined prior art above as applied to the claims set forth above and further in view of *Ajioka* and *Barrett et al.*

The independent claims have similar limitations and will therefore be argued together. The claims are directed to an antenna for communication with a satellite/satellite constellation. The antenna comprises a rotating plate for mechanically scanning for wave signals in azimuth, a plurality of radiation elements positioned on the rotating plate for receiving incoming waves, *coding circuitry*

*coupling a respective code to the element signals* and apparatus, such as a multiplexer, for consolidating all the coded element signals received at each of the plurality of radiation elements and outputting an analog bit stream. Circuitry is also included for forming multiple digital beams from the analog bit stream. The element signals are coded according to their respective locations and the strongest signal determined. The location corresponding to the strongest signal is then used to transmit the transmit beam back to the satellite. This is set forth by the inclusion of the coding circuitry mentioned above and the digital receiver that determines signal strengths for the coded element signal and locks onto a strongest signal having a corresponding element. The locked onto corresponding element can then be used for transmission. Support for the retrodirective portion is found in the specification beginning on page 13, line 14 through page 16, line 5.

As the Examiner recognized, *Karlsson et al.* fails to teach the use of a digital beamformer. (February 1, 2002 Office Action p. 2) These references thus also fail to teach at least the following: (1) a multiplexer associated with each of the plurality of radiation elements, and (2) an analog to digital converter. The two references also fail to teach or suggest the retrodirective aspect of the claims. That is, neither reference codes element signals so that the direction of the strongest signal is determined and the element with the strongest signal which in turn correspond to the waveguides illustrated in Fig. 2 is used when transmitting a beam. Also, *Karlsson et al.* fails to disclose any details about digital beamforming.

The *Chiba* reference also fails to teach retrodirectivity. No teaching or suggestion is provided for the retrodirective function. That is, no coding is performed on the system to determine the strongest signal direction. The *Chiba* reference is directed to a digital beamforming system. No teaching or suggestion has been found in this reference for the retrodirectivity described above.

The *Chang* reference, on the other hand, teaches a digital beamforming technique using temporary noise injection. In the *Chang* reference coding is provided for each of the signals. The signals are combined together in combiner 180 and provided to two analog-to-digital converters after which decoding according to the codes is performed. However, *Chang* does not teach or suggest is the use of coding for retrodirectivity. That is, the element having the strongest signal is not determined so that a transmitting beam may be transmitted using the same element. Therefore, because none of the references teach or suggest determining the strongest signal and transmitting the beam using the element corresponding to the strongest signal as identified by the element from which the signal comes, Applicants respectfully request the Examiner for a reconsideration of these rejections.

The *Aoki* reference is directed to an antenna system that is retrodirective. The retrodirectivity receives radio waves and determines their direction. The same elements are used to direct the signal back in the same direction. Fast Fourier transforms are used to sense the direction. The *Aoki* reference appears to be a fixed type of antenna and not a rotating type antenna. The retrodirectivity is completely electronically controlled. No teaching or suggestion is provided in the *Aoki* reference

for the use in combination with a rotating plate and radiation elements that are positioned on the rotating plate. The *Aoki* reference also fails to teach or suggest determining a strongest signal from an element and locking on to the strongest signal having a corresponding element, so that the corresponding element can be used for transmission. That is, the *Aoki* reference appears to teach using each of the elements to determine the direction of the incoming signal and transmits the transmitted signals using the corresponding elements.

Because the *Chang* reference and the *Aoki* reference both fail to teach using locking onto a strongest signal having a corresponding element so that the corresponding element can be used for transmission, Applicants respectfully request the Examiner to reconsider this rejection.

Claims 2, 3, 10, 12, 19, 20, and 23-24 are under 35 U.S.C. §103(a) as obvious over the combined prior art set forth above as applied to the claims set forth above and further in view of *Ajioka* and *Barrett et al.*

The *Ajioka* reference teaches the use of dual polarized slot elements in a separated waveguide cavity. No teaching or suggestion is found for the missing elements of the independent claims described above. Namely, *Ajioka* does not teach beamforming on the retrodirective aspects of the claims.

The *Barrett* reference teaches the use of a waveguide having a tracking mechanism, particularly in Col. 10, lines 32-50. The *Barrett* reference provides separate steering arrays in Col. 12, line 55-Col. 3, line 22. This adds further expense

to such a system. No teaching or suggestion is provided for the retrodirectivity features described above with respect to the independent claims.

Because claims 2, 3, 10, 12, 19, 20, and 23-24 are further limitations of their base claims, Applicants respectfully request the Examiner for reconsideration of these claims for the same reasons set forth above.

## VI. Conclusion

In light of the above amendments and remarks, Applicants submit that all objections and rejections are now overcome. The application is now in condition for allowance and expeditious notice thereof is earnestly solicited. Should the Examiner have any questions or comments, which would place the application in better condition for allowance, he is respectfully requested to call the undersigned attorney.

Respectfully submitted,

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